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THE LARGE LEAF SPOT OF CHESTNUT AND OAK

ARTHUR H. GRAVES

(WITH PLATE 69, CONTAINING 5 FIGURES)

This disease we have named the "large leaf spot" in contradistinction to the small leaf spot, the latter being common on chestnut leaves, and, as is well known, caused by the fungus, *Septoria ochroleuca* B. & C.

In the summer of 1910, during a survey of the diseases of the forest trees in the Southern Appalachian region, in collaboration with the U. S. Forest Service, the writer found the large leaf spot occurring abundantly on leaves of *Castanea dentata* in Bedford County, Virginia; in Transylvania, Jackson and Macon Counties, North Carolina, and in Rabun County, Georgia. It was found commonly also on leaves of *Quercus rubra* L. in Transylvania County, North Carolina.

A similar disease has been briefly mentioned by Stevens and Hall¹ under the title of Monochetiose, in their recent book on Diseases of Economic Plants. Stating that it is abundant in the forests on chestnut leaves, and causes much loss of vigor to the tree, they refer to *Monochaetia pachyspora* Bubák as the fungous agent. The disease which they mention may be the same as that observed by the writer, and if this is so, it is probably more correct to refer it to *Monochaetia Desmazierii* Sacc. This point, however, will require further investigation.² Beyond the brief statement in the above mentioned work, we have been unable to find any other definite reference to such a disease in the literature.

SYMPTOMS

On leaves of the chestnut, the large leaf spot begins to make its appearance (about August 1, in the localities visited) as small,

¹ Stevens, F. L., and Hall, J. G., Diseases of Economic Plants 438. 1910.

² No material of this leaf spot described by Stevens and Hall is at present available, but in all probability a new supply will be obtained this summer.

circular spots, from 1-2 cm. in diameter, on apparently healthy leaves. These spots are usually pale, with a darker line around the margin, and vary in different specimens between shades of yellow, gray, or red-brown. As the disease advances, concentric zones are added to the original diseased spot, each succeeding zone of the same nature as the original area, *i. e.*, with a darker margin bordering an interior paler area. Thus, at length, large circular spots are formed, composed of concentric, circular bands. (Pl. 69, fig. 4, and text fig. 1a.), These large spots often

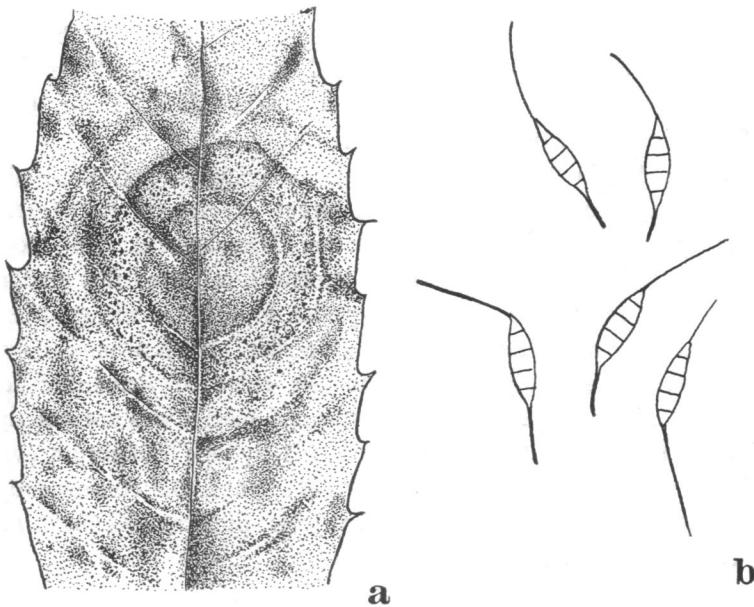


FIG. 1. a. Leaf of *Castanea dentata* showing large leaf spot. $\times 1$. b. Spores of *Monochaetia Desmazierii* Sacc. $\times 600$.

measure 5 or 6 cm. in diameter, stretching across the entire width of the leaf. Several large spots occurring on a single leaf may join each other, and the whole tissue in the distal portion of the leaf may thus be killed. Often, in this way, over half of the leaf may be killed. The zones are generally more clearly delineated on the upper surface of the leaf. The under side of the leaf has a whitish mouldy character on the margin of the diseased area, due to a projecting growth of the mycelium.

The disease as it appears on the leaves of *Quercus rubra* L. exhibits similar symptoms.

THE FUNGUS

The fungus causing this disease belongs to the order Melancoiales of the Fungi Imperfecti. Specimens have been submitted to Professor Farlow, who has pronounced it probably the same as *Monochaetia Desmazierii* Sacc. This fungus was originally described by Desmazières,³ who found it in France, growing on dry or fading leaves of several species of deciduous oaks, and also on *Quercus Ilex*. It developed not on fallen leaves, but on those which remained on the tree. Desmazières named the new species *Pestalozzia monochaeta*, thus emphasizing the fact that the spores terminated in a single bristle.

Saccardo,⁴ in the third volume of his *Sylloge Fungorum*, published in 1884, includes this and other species of *Pestalozzia* having one bristle under the section *Monochaetia*. In 1903, Allescher⁵ in Rabenhorst's *Kryptogamen-Flora* raised this section to generic rank, thus giving the species in question the name of *Monochaetia monochaeta* (Desm.) Allescher. Such a name, however, was practically contrary to the rules of nomenclature, although, indeed, the spelling of genus and species was not exactly identical. Thus, later, Saccardo⁶ in his *Sylloge Fungorum* evidently recognized the need of a further change, and consequently the name appears in his work at this time as *Monochaetia Desmazierii* Sacc.

According to Saccardo's description of the species, the spores are apparently smaller than ours. Professor Farlow has, however, examined the original material distributed by Desmazières himself, and finds that the spores there were immature. In material distributed later by Desmazières, which is mature, the measurements of the spores correspond to ours. This later material of Desmazières, moreover, corresponds to his own description, and

³ Desmazières, J. B. H. J., *Seizième Notice sur les Plantes cryptogames récemment découvertes en France*. Ann. Sci. Nat. III. 10: 355, 356. 1848.

⁴ Saccardo, P. A., *Sylloge Fungorum* 3: 797. 1884.

⁵ Allescher, Andreas, in Rabenhorst's *Kryptogamen-Flora von Deutschland, Oesterreich und der Schweiz*. ed. 2. 1⁷: 667. 1903.

⁶ Saccardo, P. A., *Sylloge Fungorum* 18: 485. 1906.

should be looked upon as the true *Monochaetia Desmazierii*. It is probable that Saccardo's smaller measurements were taken from the first lot of material distributed by Desmazières. Without going into more detail, it is sufficient for our purposes to state that the correct description of the species is given by Voglino.⁷

The spores make their appearance early in the progress of the disease, and are borne in dense clusters, or acervuli, which appear to the naked eye as small black dots on the diseased portions, usually on the upper surface of the leaf. In shape the spores are ellipsoid, and usually divided into five cells, as shown in the accompanying text figure. The three central cells are large and dark colored, while the two end cells are small and transparent. Sometimes only two, instead of three central cells appear. At the base of the spore there is a short stipe, 5-10 μ long. At the tip a long flagellum, or bristle, is borne, which usually describes a curve near its base, and is quite variable in length, 10-25 μ . The average size of the spore, including all of the cells, but omitting the stipe and flagellum, is 20 \times 6 μ .

Successful infection experiments have been carried on with this fungus. Out of a large number of chestnuts sown in the greenhouse early last November, a few germinated in December and later, without waiting over until spring. By the middle of January these furnished fine healthy young trees for inoculation. The leaves were inoculated with the spores in two ways: first, by applying the spores to the surface of the leaf after wetting it with sterilized water, and, second, by wounding the leaves and inserting the spores in the wounded spots. The infections made by the latter method were invariably successful, while the former method did not always cause the disease. On the basis of these results it would appear that wounds from insect bites or mechanical causes may probably furnish in nature the starting point of the disease in many cases, and yet there is no doubt that the fungus can enter the leaf without this assistance. It is probable that the age of the leaf has some relation to infection, and investigations along this line are now being carried on.

⁷ Voglino, P., Sul Genere Pestalozzia. Saggio Monografico. Atti della Società Veneto-Trentina di Scienze Naturali 9^o: 7. 1885.

Cultures of the fungus have been made on various media. For abundant spore production and vigorous mycelial growth Clinton's⁸ oat agar gave the best results. Figure 1 shows a plate culture two weeks old, on this medium. The spores here, in the central darker portion, are extremely dense. For comparison, figure 2 shows a culture of the same age, on potato juice agar. Here only a few acervuli, shown by the black dots, appear. In figure 3 some of the spores produced on the oat agar are shown. They are somewhat larger than those occurring in nature, and also considerably distorted. Figure 5 shows a germinating spore.

ECONOMIC IMPORTANCE AND CONTROL OF THE DISEASE

In some cases, individual trees were observed which had suffered a loss of perhaps 40 per cent. of the green assimilating tissue of their leaves as a result of the attacks of this fungus. Usually, however, the damage is much less than this, but always sufficient, it is believed, to cause a considerable diminution in the annual wood increment. Since it appears that this trouble is disseminated over the whole southern Appalachian region, it is one of considerable importance.

As far as the disease occurs in the forest, very little can be done at present to check it. In case of individual trees on private estates or in parks, however, the ordinary methods of spraying will probably prevent its recurrence. The diseased leaves should also be raked up in the fall and burned, as they harbor the fungus spores over winter.

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EXPLANATION OF PLATE LXIX

Fig. 1. Culture of *Monochaetia Desmazierii* in oat agar, two weeks old. $\times \frac{2}{3}$.

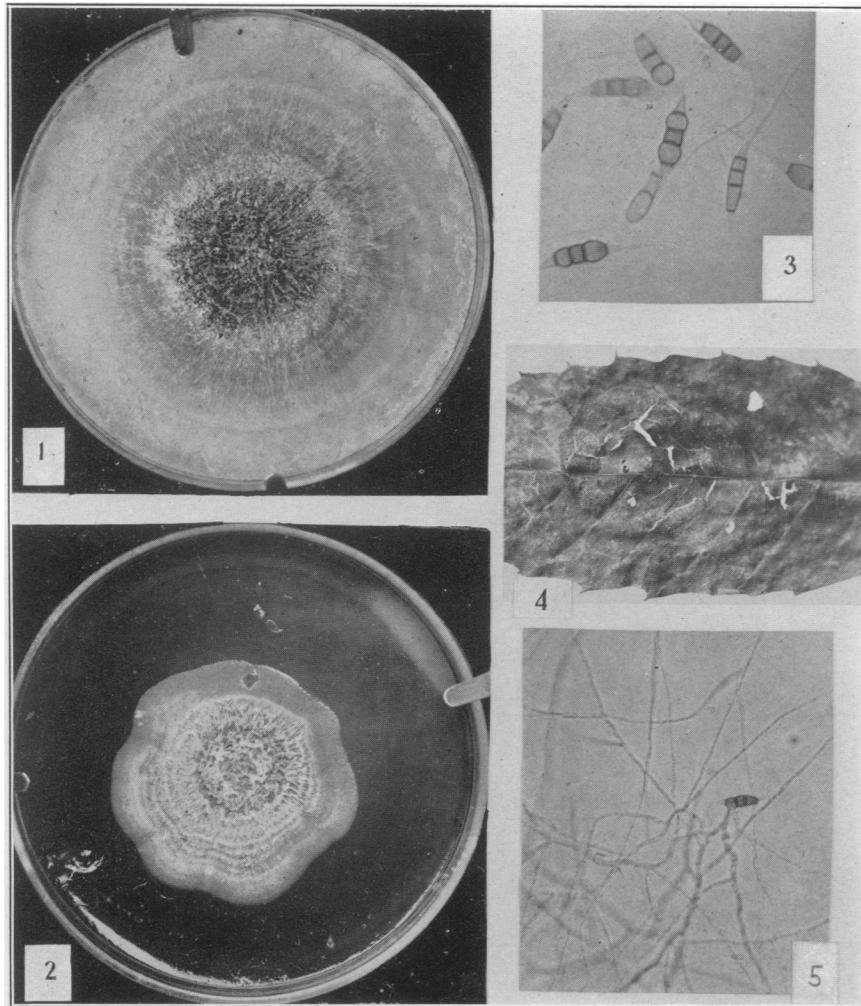
Fig. 2. Culture in potato juice agar, two weeks old. $\times \frac{2}{3}$.

Fig. 3. Photomicrograph of spores of *Monochaetia Desmazierii* Sacc. from oat agar culture. Spores somewhat abnormal, probably due to influence of culture medium. $\times 275$.

Fig. 4. Photograph of large leaf spot on leaf of chestnut. $\times \frac{2}{3}$.

Fig. 5. Photomicrograph of germinating spore of *Monochaetia Desmazierii*. $\times 230$.

⁸ Clinton, G. P., Rep. Conn. Agr. Exp. Sta. for 1909-10. 760. June, 1911.



MONOCHAETIA DESMAZIERII SACC.